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Title: **A PILOT WORKSHOP OF NUCLEAR MATERIAL ACCOUNTING AND CONTROL AT FACILITIES**

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A Pilot Workshop of Nuclear Material Accounting and Control at Facilities

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Abstract

With collaboration among the US Department of Energy, International Atomic Energy Agency (IAEA), and the China Atomic Energy Authority (CAEA), we have developed a *Pilot Workshop of Nuclear Material Accounting and Control at Facilities* and offered on May 19- June 1, 2004 in Beijing, China. The purpose of the workshop is to provide instruction in facility-level safeguards and security to participants from China and other invited countries a variation on the traditional State System of Accounting and Control (SSAC) by focusing on the nuclear material control and accounting (MC&A) measures as applied at the facility level. Moreover, the shift in emphasis from the state system of accounting and control to the facility level offers an opportunity to address insider and terrorist threats. In this manner, the traditional SSAC course would be merged with issues more closely associated with nuclear security and terrorism prevention.

All instruction and practical exercises were in English with sequential interpretation into Chinese. The workshop materials were in both English and Chinese. In addition to course lectures and invited guest lectures, all participants visited to a nuclear fuel fabrication plant used as a model for an exercise in designing the safeguards system for a bulk facility.

This paper reports the result and experience of the workshop and discusses the course evaluation from participants.

I. INTRODUCTION

A *Pilot Workshop of Nuclear Material Accounting and Control at Facilities* was developed and offered in Beijing, China on May 19–June 1, 2004. The Pilot Workshop was a collaborative effort among the US Department of Energy (USDOE), the International Atomic Energy Agency (IAEA), and the China Atomic Energy Authority (CAEA). The Pilot Workshop was presented to 20 participants from 20 nuclear facilities and organizations in China and 10 participants from five invited countries. The Pilot Workshop was a variation on the traditional State System of Accounting and Control (SSAC) course by focusing on the nuclear material control and accounting (MC&A) measures as well as insider and terrorist threats as applied at the facility level. The five invited countries were India, Japan, Pakistan, Russia, and South Korea.

The Workshop started on May 19 with welcomes and introductory remarks from IAEA, CAEA, and USDOE. It completed with a final exercise on June 1, 2004. All instruction and practical exercises were in English with sequential interpretation into Chinese. The workshop materials were in both English and Chinese. In addition to course lectures and invited guest lectures, all participants visited to the China Institute of Atomic Energy (CIAE), Beijing for nondestructive assay (NDA) demonstrations and the Baotou Nuclear Fuel Plant (BNFP), Baotou, Inner Mongolia, for an introduction to designing bulk facility MC&A. We feel the Workshop went extremely well, although some improvements can always be made.

Session 9 Integrating NMA&C and Physical Protection - Defeating the Insider Threat

- IAEA Response to Combating Nuclear Terrorism
- Integrating NMA&C and Physical Protection
- Deterring and Defeating the Insider Threat (with Exercise)

Session 10 Final Exercise - NMA&C System Design for a Fuel Fabrication Facility

Lecturers were from NNSA (M. Barlow, A. Scheinman), IAEA (P. Rodriguez, J. Vidaurre, A. Stadalnikas), CAEA (Liu Yongde, Lin Sen), LANL (D. Reilly, R. Stevens, B. Sinkule, K. Thomas, D. Wilkey, T. K. Li), and SNL (D. Beck). Guest Lectures were Y. Volodin (Russia), J. Jaloureix (France), N. Doulgeris (Australia), and W. Parks (S. Korea).

Upon completion of lectures, sessions were followed by either panel discussions, a demonstration (NDA instruments), or exercises (item facility, insider threat, bulk facility). For each of the exercises discussed below, the thirty course participants were divided into six groups of five participants. A member of the course staff was assigned to assist each group. The assignment of group members and supporting staff remained the same for all of the exercises.

III. ITEM FACILITY EXERCISE

An exercise was conducted on the designing of an NMA&C system for an item facility. The exercise was based on a hypothetical LEU research reactor as the model facility. The research reactor facility was assumed to deal only with nuclear materials in the form of discrete items (fresh fuel and spent fuel). The participants were provided with a description of the model facility including physical layout, nuclear material inventories and flows, MBA structure, and relevant operational information. Participants, working in teams, were asked to prepare descriptions of the records and reports for the example facility MBAs. The exercise ended with a group discussion of the participants' results. (Fig. 1)

Fig. 1 Group discussions.

IV. NONDESTRUCTIVE ASSAY (NDA) DEMONSTRATION

The nondestructive assay (NDA) lecture and NDA demonstrations (Session 5) were given at the CIAE Safeguards Laboratory. The NDA lecture in the morning covered basic gamma-ray spectroscopy and neutron counting techniques. It covered instruments such as the Enrichment Meter, Segmented Gamma Scanner (SGS), Tomography Gamma Scanner (TGS), High-Level Neutron Coincidence Counter (HLNC), Active Well Coincidence Counter, and the Uranium Neutron Coincidence Collar (UNCL).

Active Well Coincidence Counter (AWCC) were demonstrated. A ^{252}Cf source was used to simulate plutonium in the HLNC and group of uranium sources were measured in the AWCC, which is primarily intended for uranium assay.

- Station Four:
  Another neutron counter was demonstrated at Station Four (Fig. 3b). The Uranium Neutron Coincidence Collar (UNCL) functions like the AWCC but is designed to measure fuel assemblies. The IAEA uses this instrument primarily at fuel fabrication facilities.

Fig. 3 NDA Stations Three (a) and Four (b).

V. PHYSICAL PROTECTION-NMA&C INTEGRATION AND INSIDER THREAT EXERCISES

Two exercises were conducted during the presentation of session 9 "Integrating NMA&C and Physical Protection." The first was on the integration of the NMA&C and physical protection systems, and was designed to make the participants consider the relationship between NMA&C and physical protection. The second exercise was on the insider threat, and asked the students to consider and discuss the insider threat characteristics and system elements to mitigate that threat. In both exercises, the participants were asked to discuss the topics, following a set of questions provided as guidance, and to prepare lists of responses. The exercises concluded with a discussion of the results. (Fig. 4)

for the facility based on eight worksheets used as guidance: safeguards organization and management, material balance areas and key measurement points, measurements, measurement control, physical inventory, accounting system and material balance closing, material controls, and insider threat considerations. (Fig. 6)

Fig. 6 Group discussions of NMA&C system for final exercise.

The exercise concluded with each of the participant groups making presentations of the results of their work in the exercise, followed by comments by the course staff. Figure 7 shows group representatives presenting their group results to the Workshop.

Fig. 7 Group representatives gave the results of the final exercises to the Workshop.